CARCASS COMPOSITOIN AND MEAT QUALITY BY INTRAMUSCULAR FAT CONTENTS IN *LONGISSIMUS DORSI* OF HANWOO

Beomyoung Park, Soohyun Cho, Jinhyung Kim, Youngmoo Yoo, Jongmoon Lee, Chongnam Ahn, Yongkon. Kim, and Sanggi Yun

***National livestock research institute, Suwon, South Korea**

Key words : Intramuscular fat, meat quality, carcass composition, Hanwoo

Background

The meat quality factors of water holding capacity (WHC), meat color, texture and postmortem pH, and especially, fat content are related to sensory attributes of consumers (Van der Wal et al., 1997). Intramuscular fat (IMF) deposition is related to many factors such as breed, sex, age, nutrition, slaughtering weight, and others and it influences quality attributes such as flavor, juiciness, and tenderness. Although IMF was a poor predictor of tenderness, it continues to be the primary factor determining the quality grade of beef in Canada, Japan and the USA (Dubeski et. al., 1997). Romans (1965) reported that steaks containing high intramuscular fat were juicier than steaks containing low IMF, even though there was no significant difference in WBS. Shackelford et. al. (1994) showed that there was little relationship between beef carcass grade and backfat thickness in terms of tenderness and WBS. On the other hand, Miller et. al. (1997) reported that "Choice" grade scored higher in sensory evaluations than "Select" grades of US beef. Although extension of feeding periods and high-energy feeding are currently being suggested for increasing IMF content, it was shown that they also had an influence on the backfat accumulation. At present, there is limited information about carcass composition and meat quality according to the IMF content of Hanwoo, which is the Korean native breed of cattle.

Objective

The objective of this study was to compare the carcass composition and meat quality according to the IMF content of Hanwoo.

Materials and Methods

Animals: Korean native bulls (n=69) and steers (n=133) were slaughtered and their carcasses were chilled for 24 hours at 1℃. Loin muscles were separated and divided into five groups according to their intramuscular fat content (<3%, 3-5.9%, 6-9%, >12%).

Carcass evaluation: A section of the longissimus muscle (extending from the last thoracic vertebra to the first lumbar vertebra) was removed from the short loin of each carcass, and carcass weight, bone weight, backfat thickness and longissimus muscle area were recorded. Carcass yields were calculated based on live weight.

Meat quality evaluation: At 24hr postmortem, each carcass was ribbed between the 11th and 12th ribs and the loin muscles were vacuum packed and stored at 5℃ until determination of their chemical composition (AOAC, 1990), water holding capacity (Ryoichi, 1993), shear force, cooking loss and sensory evaluation along a 6-point scale (6=very juicy, very tender, very intense; 1=very dry, very tough, very weak). To measure WBS (Warner-Bratzler Shear Force), loin muscles were cut into cubes (3cm thickness), heated to an internal temperature of 77℃ in a waterbath; cooled and measured. Cooking loss was determined by dividing (raw weight-final cooked weight) by raw weight and multiplying that figure by 100.

Results and Discussion

There were no significant differences in live weight, cold carcass weight and loin muscle area according to IMF content ($p<0.05$) (Table 1). The backfat thickness and total separable carcass fat increased as IMF content increased within the range of <11.9%. In carcass composition, the percentage of bone decreased as IMF content increased. In meat quality characteristics, protein, moisture, ash content, cooking loss and WBS decreased as IMF content increased (Table 2). In sensory evaluation, meat containing high IMF showed significantly higher scores in juiciness, tenderness and flavor when evaluated on the 6-point scale. ($p<0.05$). There was a positive correlation coefficient between IMF content and factors related to fat, such as backfat thickness, total separable carcass fat, subcutaneous fat, kidney fat and abdominal fat; whereas IMF content was negatively correlated with bone percentage. (Table 3).

Conclusions

From the results of this study, it can be seen that IMF content is significantly correlated with backfat thickness, WBS and sensory characteristics in Hanwoo bulls and steers. For the production of high-quality Hanwoo meat, it is necessary to increase the rate of IMF and decrease the rate of inedible fat. In the future, feeding technology to decrease the rate of backfat thickness, kidney fat and abdominal fat must be developed in order to improve the meat quality of Hanwoo. However, the reasons why the bone rate decreased

Table 1. Carcass Characteristics by Intramuscular fat content of Hanwoo

Items	Intramuscular fat content(%)				
	< 3.0	3.0~5.9	6.0~8.9	9.0~11.9	12.0<=
Number of Animals	14	73	62	39	14
Live weight (kg)	547.6	568.97	567.99	560.26	546.54
Cold carcass weight (kg)	338.96	354.16	355.59	350.27	341.34
Retail cut weight (kg)	211.34^{ab}	222.90^{a}	223.39^{a}	215.25^{ab}	201.39^{b}
Loin muscle area (cm^2)	87.17^{a}	86.91^{a}	85.72^{a}	83.99^{a}	84.14^{a}
Backfat thickness(cm)	0.79^{c}	1.05^{bc}	1.36^{ab}	1.51^{a}	1.30^{ab}
Carcass yields (%)	61.90	62.43	62.60	62.23	62.45
Retail cut (%)	38.20^{ab}	39.01^{ab}	39.26^{a}	38.41^{ab}	36.95^{b}
Bone yield (%)	7.18^{a}	6.86^{b}	6.58^{c}	6.52^{c}	6.51^{c}
Total separable carcass fat (%)	14.80^{c}	18.58^{b}	20.91^{ab}	21.59^{a}	19.86^{ab}

Table 2 Meat quality properties by Intramuscular fat content of Hanwoo.

Items		Intramuscular fat content(%)				
		< 3.0	3.0~5.9	6.0~8.9	9.0~11.9	12.0<=
Number of Animals		14	73	62	39	14
Moisture (%)		73.65^{a}	72.29^{b}	70.14^{c}	68.46^{d}	64.42^{e}
Ash (%)		1.05^{a}	1.01^{a}	0.96^{b}	0.92^{bc}	0.91^{c}
Protein (%)		22.02^{a}	21.64^{a}	20.80^{b}	20.32^{c}	19.24^{d}
Fat (%)		2.32^{e}	4.63^{d}	7.40^{c}	10.13^{b}	14.78^{ab}
Cooking loss (%)		34.97^{a}	32.18^{ab}	30.30^{b}	30.30^{b}	30.95^{b}
WBS ($kg/0.5in^2$)		6.47^{a}	5.72^{ab}	4.85^{bc}	4.35^{c}	4.11^{c}
WHC		41.70^{a}	40.10^{ab}	38.82^{ab}	35.79^{b}	42.22^{a}
Sensory Property -ies*	Juiciness	3.91^{c}	3.99^{c}	4.32^{b}	4.38^{b}	4.76^{a}
	Tenderness	3.03^{d}	3.46^{c}	3.74^{bc}	3.96^{b}	4.31^{a}
	Flavor	4.10^{c}	4.22^{c}	4.44^{b}	4.49^{b}	4.79^{a}

*Based on a 6-point scale (6=very juicy, very tender, very intense; 1=very dry, very tough, very weak).

as IMF content increased needs to be further investigated from the point of view of growth patterns and fat accumulation in breeding and feeding areas.

Table 3. Correlation between separable fat yields and Intramuscular fat content of Hanwoo.

	Backfat thickness	Total Separable carcass fat	Subcutaneous fat (%)	Bone yield (%)s	Kidney fat(%)	Abdominal fat (%)	Internal organs fat (%)	Heart fat (%)
Intramuscular fat contents	0.27782	0.32814	0.26447	-0.44060	0.33599	0.31905	0.22746	0.24163
Prob > |R| under Ho: Rho=0	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0011	0.0005

References

1. A. O. A. C. 1990. "Official Methods of Analysis" 15th ed. Assosiation of Official Analytical Chemists. Washington, D. C.
2. May, S. G., H. G. Dolezal, D.R. Gill, F. K. Ray and D. S. Buchanan. 1992. Effects of days fed, carcass grade traits and subcutaneous fat removal on postmortem muscle characteristics and beef palatability. J. Anim. Sci. 70:444.
3. Miller, M. F., C. R. Kerth, J. W. Wise, J. L. Lansdell, J. E. Stowell and C. B. Ramsey. 1997. Slaughter plant location, USDA quality grade, external fat thickness, and ageing time effects on sensory characteristics of beef loin strip steak. J. Anim. Sci. 75:662.
4. Romans, J. R., H. J. Tuma and W. L. Tucker. 1965. Influence of carcass maturity and marbling on the physical and chemical characteristics of beef. J. Anim. Sci. 24:681.
5. Ryoichi, S., T. Degychi and Y. Nagata. 1993. Effectiveness of the filter paper press method for determining the water holding capacity of meat Fleischwirtsch, 73:1399.
6. SAS. 1996. SAS/STAT user's guide.
7. Shackelford, S. D., D. M. Koohmaraie and T. L. Wheeler. 1994. The efficacy of adding a minimum adjusted fat thickness requirement to the USDA beef quality grading standards for select grade beef. J. Anim. Sci. 72:1502.
8. Van der Wal, P. G., Engel, B. and Hulsegge, B. 1997. Causes for variation in pork quality. Meat Sci. 46(4):319.